

Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Previously Presented) A method for increasing a time dependent dielectric breakdown lifetime of a semiconductor device having a first layer underlying a second layer, the method comprising:

forming a glue layer on the first layer;

performing an inter-treatment on the glue layer, wherein the inter-treatment affects the upper and lower surfaces of the glue layer and improves an adhesive interface between the glue layer and the first layer; and

depositing the second layer directly onto the upper surface of the inter-treated glue layer, wherein the inter-treated glue layer improves adhesion between the first and second layers, wherein the second layer is a metal layer.

2. (Original) The method of claim 1 further comprising performing a pre-treatment on the first layer before forming the glue layer.

3. (Original) The method of claim 1 wherein performing the inter-treatment on the glue layer includes applying a plasma to the glue layer.

4. (Original) The method of claim 3 wherein applying the plasma to the glue layer further includes selecting a reacting gas, a process time, a process temperature, a process pressure, and a reacting gas flow.

5. (Original) The method of claim 4 wherein the selected reacting gas is a hydrogen based gas.

6. (Original) The method of claim 4 wherein the selected reacting gas is a helium based gas.

7. (Original) The method of claim 4 wherein the selected process time is between approximately 1 and 100 seconds, the selected process temperature is between approximately 200 and 400° C, the selected process pressure is between approximately 0.5 and 10 torr, and the selected reacting gas flow is between approximately 100 and 2500 sccm.

8. (Original) The method of claim 1 wherein performing the inter-treatment on the glue layer includes directing an electron beam towards the glue layer.

9. (Original) The method of claim 8 wherein directing the electron beam towards the glue layer further comprises defining a process power and a dosage.

10. (Original) The method of claim 9 wherein the process power is between approximately 1000 eV and 8000 eV.

11. (Original) The method of claim 9 wherein the dosage is between approximately 50 and 500 $\mu\text{C}/\text{cm}^2$.

12. (Previously Presented) A method for increasing a dielectric breakdown lifetime of a semiconductor device, the method comprising:

depositing a dielectric layer;

depositing a glue layer on the dielectric layer;

selecting either a plasma treatment process or an electron beam treatment process;

applying the selected treatment process to affect the upper and lower surfaces of the glue

layer;

forming a metal layer directly on the upper surface of the glue layer, wherein the treatment process enhances an adhesiveness between the dielectric layer and the metal layer.

13. (Original) The method of claim 12 further comprising selecting a thickness for the glue layer, wherein the selected thickness is based at least partially on a desired electrical property of the glue layer.

14. (Original) The method of claim 13 further comprising adjusting a property of the selected treatment process based on the selected thickness of the glue layer.

15. (Original) The method of claim 14 wherein the adjusted property is associated with a duration of the selected treatment process.

16. (Previously Presented) The method of claim 12 further comprising selecting a material for forming the glue layer, wherein the material is selected from the group consisting of SiN, silicon oxide, SiCH, SiCN, and SiCO.

17. (Original) The method of claim 12 wherein the selected process is the plasma treatment process, and wherein a reacting gas to be used in the plasma treatment process is selected from the group consisting of a hydrogen based gas and a helium based gas.

18-20 (Cancelled)

21. (Previously Presented) A method for improving an interface in a semiconductor device comprising:

forming a first metal layer;

forming a glue layer on the first metal layer;
performing an inter-treatment on the glue layer to alter upper and lower surfaces of the glue layer for improved adhesiveness; and
forming a second metal layer on the upper surface of the glue layer such that an interface is formed directly between metal of the second metal layer and the upper surface of the glue layer.

22. (Cancelled)

23. (Previously Presented) The method of claim 21 wherein performing the inter-treatment includes using at least one of a plasma or an electron beam.

24. (Previously Presented) The method of claim 21 further comprising selecting a material for forming the glue layer, wherein the material is selected from the group consisting of SiN, silicon oxide, SiCH, SiCN, and SiCO.

25. (Previously Presented) A method for improving an interface in a semiconductor device comprising:

forming a first metal layer;
forming a glue layer directly on the first metal layer;
performing an inter-treatment on the glue layer to alter upper and lower surfaces of the glue layer for improved adhesiveness; and
forming a second metal layer on the upper surface of the glue layer.